PROFESSIONAL SERVICES

Creating Sustainable Business Advantage

Certification Cost Analysis - Updated

July 6, 2000

Prepared for:
Ken Adrian
State of Iowa, IT Department
ITS 'B' Level, Hoover Building
Des Moines, IA 50319

Prepared by:
Professional Services
10 Fawcett Street
Cambridge, MA 02138

Table of Contents

1.0 Introduction

This document provides a generic analysis of costs and revenues related to running a CA. This analysis is called out as part of the PKI Architecture task of this consulting engagement, although it is presented here in a separate document. It covers two cases:

- The State of Iowa runs its own CA from its own facility using hardware and software purchased from various vendors, including a CA vendor
- The State contracts out the CA operation to a service vendor, which runs a CA hosting service out of its own facility.

The analysis is provided in the form of an Excel spreadsheet, which the text of this document accompanies and explains. This spreadsheet is based on a configurable analysis tool prepared by Professional Services, which has been extensively modified to more closely fit the circumstances of the State of Iowa PKI. A sample static case is attached to this document. However, parameters in the spreadsheet can be modified at will to try out various assumptions, and to best fit the State's assumptions as they are refined.

Please note that the spreadsheet is a proprietary product of Baltimore Technologies, which the IT Department of the State of Iowa can use for its own purposes but cannot give to others.

2.0 Explanation of Spreadsheet

This section walks through the spreadsheet row by row, explaining the major cost factors. It also provides detailed backup for a few of the larger cost elements. The State is of course free to change any cost values or other assumptions for its own analyses.

2.1 Columns

The spreadsheet columns first define the cost elements (column A), and include in columns B and C some parameters used in following calculations. Then column C covers one-time initial setup costs. After that is a column (D through H) for each of several years. The years start with 2002 on the assumption that a CA is first set up then, with full operation beginning in 2003. This is because July 1, 2003 is when the recent State electronic commerce law requires State agencies to offer services over the Internet with digital signatures that up to now have required face-to-face interaction with handwritten signatures. Column I totals the costs for all years presented. The remaining column at the right provides brief comments about what is in each row.

The rows then calculate, for initial installation and each year, various cost and revenue elements.

2.2 Revenue: Rows 3 through 23

The first set of rows (3 through 23) calculate estimated revenue from certificates. This spreadsheet was originally intended partly to support business cases for commercial customers. Thus the revenue assumptions may not exactly match the way State agencies operate. In particular, making a profit is not a goal for the State the same way it is for a commercial venture. However, it is still useful to be able to estimate the revenue brought in by selling certificates, for example to help plan for any subsidization by the State.

There are three classes of certificates, as discussed in the PKI Requirements Assessment and the PKI Architecture documents that Professional Services has already delivered to the State. The first class, covered in row 5 through 7, are simple certificates obtained over the Internet, for which the certificate requestor typically fills out a web form on his or her browser. This request will include authentication data such as social security number, address, etc. as appropriate, which helps a Registration Authority (RA) to decide whether to approve the certificate request in the authentication step. The second class of certificates, in rows 9 through 11, are similar except that a pre-placed shared secret is provided by the State to potential users or vice versa, and when a user requests a certificate he or she must provide that shared secret with the electronic request form. The third class requires a face-to-face meeting of the requestor with a State official, who may require documentation or other authentication, and then notifies the RA that the certificate can be issued as far as the officer is concerned. For each class, a separate charge per certificate (in column C) and number of certificates for each year can be filled in (rows 6, 10 and 14).

Another possible source of "revenue", at least as far as the IT Department is concerned, might be charges to other agencies that have their own subordinate CAs. This is covered in rows 17 through 21. This assumes a charge per subordinate CA. The State may or may not choose to actually have payments transferred from agencies to the IT Department. These rows can be left blank if such payments are not anticipated.

Row 23 totals all the revenues from all the prior rows.

2.3 Expenditures for State-Operated CA: Rows 26 through 52

These rows calculate expenses on the assumption that the State operates its own CA in its own facility. This involves expenses such as purchasing items from vendors: CA software, hardware such as computers to run the CA software, and supporting third-party hardware such as routers and other communications or computing support. There are also one-time costs for installation support and additional PKI consulting. Rows 33 and 34 show yearly maintenance costs, such as required maintenance contract charges for the items in the first three rows, as a percentage of initial cost. Finally row 35 shows an estimated cost for miscellaneous software, not from the CA or computer vendors, for each year. This includes database and security software, for example. Row 36 totals these CA software and platform costs.

Rows 38 through 50 show the costs related to preparation and operation of a facility to house the CA. This includes one-time or recurring costs, as appropriate, for construction, addition of security monitoring equipment, and salaries for CA site personnel or supporting staff such as legal and marketing. Two large costs are broken down below in somewhat more detail:

Building improvements of $500,000 (cell 39C): This is based on experience preparing the CyberTrust (now Baltimore) hosting facility in the U.S. It includes the following approximate costs:

- Architect and engineering plans, coordination with existing clients, and other planning: $50K
- Site preparation, overhaul of existing facility: $150K.
- Walls: floor-to-ceiling walls with embedded metal mesh or plate. Significant material and installation costs: $100K.
- Other construction, primarily secure room doors, ceiling tile, floors, and ventilation ducting: $50K
- Wiring, not just electrical, but for various security-related signals (see next paragraph): $50K.
- Uninterruptible power supply (UPS): $50K.
- Internet hookup: $20K.
- Miscellaneous – safes, furniture, lights, etc.: $30K.

Security equipment ($100,000): This includes the following new security-related devices, all of which require hookup, monitoring, and auditing:

- Closed circuit TV (CCTV) cameras and recorders, with tape management system: $50K.
- Infrared motion detectors, which may be tied into the camera recording system to minimize amount of tape: $20K.
- Card readers and associated logic to enforce two-person access to secure rooms: $20K.
- Biometric devices such as fingerprint readers (optional): $20K if used.

Salaries (row 42) are based on a separate schedule at the bottom of the spreadsheet (rows 69 through 78). This assumes 5.5 persons, which we feel is the minimum for a 24 x 7 site. This assumes that during slow periods (e.g., at night) only one person is present, and that any failures in a secure CA room are handled by paging another person who is on call for such emergencies. Normal customer support activities that can be handled via remote terminals, without entering the secure rooms, do not require such two-person control. (Refer to the PKI Requirements Assessment for a list of typical CA staff members.) If a site operates for fewer hours per day, and thus may have to tolerate occasional down-time, this number can be reduced somewhat. On the

other hand, if immediate response to any failure is required, a minimum of two persons per 8-hour shift is needed to meet a two-person access security requirement, which raises the number of staff members to perhaps 8 or 9. Salary overhead (benefits) rates can be adjusted to meet State experience. An average salary increase of 10% per year is built into row 42 formulas, which can be adjusted if desired.

Then starting in row 44 are expenses for Internet connection, web site development, insurance, rent (or equivalent building expenses), and other site- or personnel-related expenses. These site-related expenses are totaled in row 51, and finally row 52 provides the grand total of both CA software/hardware and site-related costs.

Row 65 provides the "profit" (or for State operations, revenue less expenses) under this assumption of a State owned and operated CA and facility.

2.4 Expenditures for Outsourced CA: Rows 55 through 62

These rows calculate expenses on the assumption that the State outsources the CA, by paying a service vendor to perform CA operations in its own hosting facility. Such as CA service provider may charge a fixed charge, then charges for additional subordinate CAs, RAs, and a per-certificate charge. The number of subordinate CAs and certificates are taken from earlier rows, as noted at the far right comments. These charges are typically pro-rated, so reasonable average rates for the anticipated Iowa certificate-related operations are used in column B. If and when actual vendor quotes are provided, this section can be revised accordingly.

Row 66 provides the "profit" under this assumption of an outsourced CA.

2.5 Conclusions

Using the assumed rates and number of certificates, it appears that operating its own CA facility costs more than outsourcing, at least for the first few years. (Compare rows 65 and 66.) This is largely because of the large fixed cost of building a secure facility, and the large recurring personnel costs, which are not balanced initially by the number of certificates. Since CA hosting facilities such as those operated by Baltimore and VeriSign are already built, and there is an economy of scale due to their support for other customers, outsourcing costs are somewhat less.

Under the assumptions provided in the example, the State would not make a profit until there are a significant number of certificates. The break-even point comes much sooner for an outsourced CA than for a State-operated CA.

Extrapolation beyond the years shown, increasing the assumed number of certificates beyond about 200,000, or increasing the cost per certificate would make a State-operated facility more reasonable. Also, of course, there may be legal or operational control reasons for the State to operate its own CA facility. This has convinced several foreign organizations to run their own CAs. But it should be noted that CA hosting facilities can still give physical control of the State root to the State of Iowa (by putting its cryptographic module in a safe and not allowing hosting facility personnel access), and the two likeliest facilities are still both in the U.S. (Baltimore's in Massachusetts and VeriSign's in California).

Appendix 1. Example Spreadsheet

(Baltimore Technologies Proprietary – Do not distribute further)

Cash Flow - Revenue Projections					Example				Actions - please read full text
Revenue model breakdown			**2002**	**2003**	**2004**	**2005**	**2006**	**Total**	
Simple Authentication Certs		Charge per cert							
number of certs issued		$5	500	10,000	20,000	40,000	80,000		**Number of certs and expected charge per cert**
Revenue			**$2,500**	**$50,000**	**$100,000**	**$200,000**	**$400,000**	**$752,500**	**for certs obtained over Internet**
Shared-secret Authentication Certs		Charge per cert							
number of certs issued		$10	500	10,000	20,000	40,000	80,000		**Number of certs and expected charge per cert**
Revenue			**$5,000**	**$100,000**	**$200,000**	**$400,000**	**$800,000**	**$1,505,000**	**for certs requiring preset shared secret**
Face-to-face Authentication Certs		Charge per cert							
number of certs issued		$100	100	500	1,000	2,000	3,000		**Number of certs and expected charge per cert**
Revenue			**$10,000**	**$50,000**	**$100,000**	**$200,000**	**$300,000**	**$660,000**	**for certs requiring physical presence (may include web server certs)**
CA Operation: Charges to other departments									
Number of Sub CAs, issuing up to 5000 certs e		1	1	4	8	16	32		**Number of CAs operated for other departments**
Annual Charge per CA		$60,000	$60,000	$240,000	$480,000	$960,000	$1,920,000	$3,660,000	**Annual fee, as appropriate**
Annual Support	15%	$9,000		$36,000	$72,000	$144,000	$288,000	$540,000	**Support should be at least 15% of annual fee**
Revenue				**$276,000**	**$552,000**	**$1,104,000**	**$2,208,000**	**$4,140,000**	
Total Revenues			**$17,500**	**$476,000**	**$952,000**	**$1,904,000**	**$3,708,000**	**$7,057,500**	**Total revenue**

Expenditure Projection if State Owned & Operated CA

Systems Costs		One-time costs	**2002**	**2003**	**2004**	**2005**	**2006**	**Total**	
CA Software		$500,000						$500,000	**CA software licensing price**
CA Hardware		$400,000						$400,000	**Hardware (workstations, web servers)**
Third Party Hardware - routers networks etc		$50,000						$50,000	**Third party products**
CA Software Installation costs		$45,000						$45,000	**CA software installation costs**
Consulting support - year 1			$300,000					$300,000	**Consultants from CA vendor or others**
CA Software Maintenance	18%			$90,000	$90,000	$90,000	$90,000	$360,000	**CA software support at 18%**
Hardware Maintenance	15%			$60,000	$60,000	$60,000	$60,000	$240,000	**Hardware support at 15%**
Third Party Software	Est.			$50,000	$50,000	$50,000	$50,000	$200,000	**Estimated figure for 3rd-party SW & maintenance**
Total Systems costs		**$995,000**	**$300,000**	**$200,000**	**$200,000**	**$200,000**	**$200,000**	**$2,095,000**	**Total CA-related costs**
Infrastructure Costs		One-time costs							
Building improvements		$500,000						$500,000	**Estimate to fix building to required standard**
Security equipment improvements		$100,000						$100,000	**Cameras, motion sensors, card readers, biometrics**
Office equipment Safes, furniture etc		$35,000						$35,000	**Safes, secure cabinets etc**
Salaries - See Schedule			$900,000	$990,000	$1,089,000	$1,197,900	$1,317,690	$5,494,590	**From schedule at bottom**
Legal fees (CPS and local costs)			$80,000	$40,000	$40,000	$40,000	$40,000	$240,000	**For writing CPS and signing agreeements**
Internet connection infrastructure			$65,000	$75,000	$90,000	$100,000	$110,000	$440,000	**For ISP Internet-related costs**
Web site development			$60,000	$60,000	$60,000	$60,000	$60,000	$300,000	**Estimated**
Marketing			$40,000	$40,000	$45,000	$45,000	$50,000	$220,000	**To promote the service**
Insurance - property, casualty, liability etc			$100,000	$100,000	$100,000	$100,000	$100,000	$500,000	
Rent - 600 sq ft at $50 psf			$30,000	$30,000	$30,000	$30,000	$30,000	$150,000	**Estimate of size and cost required**
Travelling expenses			$15,000	$15,000	$15,000	$15,000	$15,000	$15,000	**General travelling expenses**
Other			$5,000	$5,000	$5,000	$5,000	$5,000	$25,000	**Training, replacements & upgrades, applications, …**
Total Infrastructure Costs		**$635,000**	**$1,295,000**	**$1,355,000**	**$1,474,000**	**$1,592,900**	**$1,727,690**	**$8,019,590**	**Total facility-related costs**
Total Expenditure: State-Owned		**$1,630,000**	**$1,595,000**	**$1,555,000**	**$1,674,000**	**$1,792,900**	**$1,927,690**	**$10,114,590**	**Total expenses for State-operated CA & facility**

Expenditure Projection if Outsourced CA

Hosting Costs	Per year	One-time costs	**2002**	**2003**	**2004**	**2005**	**2006**	**Total**	
Basic CA Charge	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$300,000	**Basic fixed charge per year**
Charge per Subordinate CA	$25,000	$25,000	$25,000	$100,000	$200,000	$400,000	$800,000	$1,550,000	**Based on number of Sub CAs in line 18**
Number of RAs		5	10	40	80	160	320		**Number of RAs (considering # of Sub CAs above)**
Charge for extra RAs	$1,000	$5,000	$10,000	$40,000	$80,000	$160,000	$320,000	$615,000	**Based on number of RAs above**
Charge per certificate	$3		$3,300	$61,500	$123,000	$246,000	$489,000	$922,800	**Based on number of certs in lines 6, 10 and 14**
Total Expenditure: Outsourced		**$80,000**	**$88,300**	**$251,500**	**$453,000**	**$856,000**	**$1,659,000**	**$3,387,800**	**Total Ousourced CA-related costs**
Revenue less cost ("profit"):									
If State-owned CA		**-$1,630,000**	**-$1,577,500**	**-$1,079,000**	**-$722,000**	**$111,100**	**$1,780,310**	**-$3,057,090**	
If Outsourced CA		**-$80,000**	**-$70,800**	**$224,500**	**$499,000**	**$1,048,000**	**$2,049,000**	**$3,669,700**	

Salary schedule

Function	**No.**	**Salary Average**	**Salary Cost**	**Fringes 50%**	**Total cost**	
CA operations staff	5.5	80000	$440,000	$220,000	$660,000	**Number of staff and average salary**
Sales/Mktg staff	1	75000	$75,000	$37,500	$112,500	**Number of staff and average salary**
Sales Technical support engineer	1	85000	$85,000	$42,500	$127,500	**Number of staff and average salary**
Total			**$600,000**	**$300,000**	**$900,000**	**Fringes (personnel overhead cost) as % of salary**
(Indexed by 10% pa for future years)						